1.2. Medication Dosing in Overweight and Obese Patients

Table 1.2-1. Equations for Body Size Estimates[a]

Body Size Descriptors		Units	Intended Age (Sex)
GENERAL			
Body mass index (BMI)	(ABW in kg) / (height in m)^2	kg/m^2	Adult
	(ABW in kg) / (height in m)^2 adjust by growth charts for age and sex	%	Child
Body surface area (BSA)	[(ABW in kg)$^{0.425}$ × (height in cm)$^{0.725}$] × 0.007184	m^2	Adult
	SQRT [(height in cm) × (ABW in kg) / 3600]	m^2	Child/adult
	[(ABW in kg)$^{0.5378}$ × (height in cm)$^{0.3964}$] × 0.024265	m^2	Infant/child/adult
LEAN BODY MASS			
Ideal body weight (IBW)[b]	50 kg + 2.3 kg [(height in inches) – 60]	kg	Adult (male)
	45.5 kg + 2.3 kg [(height in inches) – 60]	kg	Adult (female)
	2.05 e$^{(0.02)\ (\text{Height in cm})}$	kg	Child < 5 feet
	39 kg + 2.27 kg [(height in inches) – 60]	kg	Child ≥ 5 feet (male)
	42.2 kg + 2.27 kg [(height in inches) – 60]	kg	Child ≥ 5 feet (female)
Lean body weight (LBW)	[1.1 × (ABW in kg)] – {120 × [(ABW in kg)/ (height in cm)]^2}	kg	Adult (male)
	[1.07 × (ABW in kg)] – {148 × [(ABW in kg)/ (height in cm)]^2}	kg	Adult (female)
Fat-free mass (FFM)	[0.285 × (ABW in kg)] + [12.1 × (height in m)^2]	kg	Adult (male)
	[0.287 × (ABW in kg)] + [9.74 × (height in m)^2]	kg	Adult (female)
	[9270 × (ABW in kg)] / [6680 + (216 × BMI)]	kg	Adult (male)
	[9270 × (ABW in kg)] / [8780 + (244 × BMI)]	kg	Adult (female)
ADJUSTED BODY SIZE			
Adjusted body weight	(IBW in kg) + {[(ABW in kg) – (IBW in kg)] × 0.2 to 0.6}[c]	kg	Adult
Predicted normal weight	[1.57 × (ABW in kg)] – [0.0183 × BMI × (ABW in kg)] – 10.5	kg	Adult (male)
	[1.75 × (ABW in kg)] – [0.0242 × BMI × (ABW in kg)] – 12.6	kg	Adult (female)

ABW, actual body weight; SQRT, square root.

[a]There are a number of variations of these formulae, but only the most commonly cited and recently introduced versions are listed; some of the equations are inappropriate or have not been validated for use in more extremely obese patients.

[b]Although ideal body weight in adults was originally used as a target weight for life insurance tables, it has since been used as a surrogate for lean body mass, albeit based on tenuous assumptions.

[c]Various adjustments for various medications have been reported where the adjustment adds 20% to 60% of the difference between ABW and IBW to the IBW for medications not as well distributed into adipose tissue.

Self-Assessment Problems

1. A 63-year-old male was admitted to the ICU for shock after a motor vehicle accident. He now has suspected pneumonia. He weighs 140 kg and his IBW is 80 kg.

   What dosing weight (actual, ideal, some other) should be used for the following medications (in kg) for patients like this one?

   A. Vancomycin
   B. Tobramycin
   C. Enoxaparin for treatment of embolism
   D. Morphine for acute pain
   E. Digoxin

2. The FDA recently approved a new intravenous antibiotic for severe infections. The approved dosage consists of a 1000-mg loading dose and a 500-mg daily maintenance dose for patients with normal renal function.

   A post-marketing study examined the pharmacokinetic parameters of the antibiotic in obese and non-obese patients using the same dosage scheme. The volume of distribution and clearance in the non-obese (mean weight 80 kg) was 48 L and 80 mL/min, respectively. The volume of distribution and clearance in the obese patients (mean weight 120 kg) was 52 L and 130 mL/min, respectively.

   A morbidly obese patient who weighs 180 kg is to be treated with this new antibiotic and the prescriber asks for recommendations on drug dosing. No other patient-specific problems, such as renal dysfunction, are expected to substantially affect dosing recommendations.

   A. What loading dose should be recommended for this patient and why?
   B. What maintenance dose should be recommended for this patient and why?

3. Determine the following for a 6'4" tall male who weighs 198 lb.

   A. Lean body weight
   B. Ideal body weight
   C. Body mass index
   D. Fat-free mass (using both available equations)

4. Which of the following factors is least likely to be taken into consideration with common equations (e.g., IBW, adjusted weight, BMI) used for dosing medications in obese patients?

   A. Height
   B. Weight
   C. Body composition
   D. Sex

5. BMI is increasingly being used to determine whether subjects are overweight or obese. Which one of the following statements regarding BMI for the dosing of medications is true?

   A. Most pharmacokinetic studies investigating drug dosing in obese patients have adjusted doses based on BMI.
   B. Patients with a BMI greater than 25 should have their doses based on IBW if the drug is highly lipid soluble.
   C. Dosing of medications is most difficult in patients with BMIs greater than 40 because there are few studies in this population.

6. Which of the following would best justify the use of actual weight for determining a weight-based dosing regimen (load and maintenance) for an obese patient?

   A. Proportional increase in the volume of distribution but no change in clearance with increasing weight.
   B. Proportional increase in clearance but no change in volume of distribution with increasing weight.
   C. Proportional increases in volume of distribution and clearance with increasing weight.
   D. No change in either volume of distribution or clearance with increasing weight.